Joint Countermine Advanced Concept Technology Demonstration, Demonstration I Quicklook Report Executive Summary

Introduction

Demonstration I of the Joint Countermine Advanced Concept Technology Demonstration was completed on 5 September 1997. The Johns Hopkins University Applied Physics Laboratory (JHU/APL) and the Center for Naval Analyses (CNA) have been given responsibility for joint analysis of the Demonstrations (see attachments). This annotated briefing is therefore a collaborative effort between JHU/APL and CNA, and constitutes the state of analysis completed as of 60 days post-demonstration. Conclusions and analysis results contained in this Quicklook Report are being used to guide the planning for the second demonstration, which will be in the May-June 1998 timeframe.

After a short introduction to the Countermine ACTD program, the report describes the countermine overlay to Joint Task Force Exercise (JTFEX) 97-3 that constituted Demonstration I. The countermine scenario overlay was divided into several "sub-phases" to facilitate planning and analysis, as they represented natural Navy, Marine, and Army missions conducted within the Presence, Hostilities and Decisive Combat Phases of the JTFEX. For clarity of presentation, analyses of some of the sub-phases have been combined in the report. Finally, the conclusions section directly relates what has been learned from Demonstration I to the four Critical Operational Issues identified by the operational sponsor, United States Atlantic Command (USACOM) and identifies how the enlarged scope of Demonstration II activities will complete the assessment.

JCM ACTD Overview

The Joint Countermine ACTD provides 13 pre-production systems to the warfighter for his assessment of military utility, which will be a primary factor regarding systems acquisition decisions. The technologies and systems were selected because they were judged to (1) fulfill a critical countermine need and (2) they were technologically mature enough so that their acquisition could be accelerated were they judged by the warfighter to provide exceptional military value. Recognizing that these systems must be interoperable within an existing, legacy system of systems, an enhanced countermine C4I architecture was devised to foster interoperability and provide a coherent countermine tactical picture to all levels of command. Realistic play of these novel systems utilizing new concepts of operations (CONOPS), together with the enhanced C4I system and the Joint Countermine Operational Simulation (JCOS) are intended to provide sufficient information for USACOM to assess their military utility.

The vision of the Countermine ACTD is to fill in the current capability gaps in the critical sea to land transition zone necessary to enable seamless movement during an amphibious operation and subsequent movement to contact with the enemy. Because clandestine reconnaissance has been highlighted as a critical need by various national countermine study panels, the ACTD has sought to emphasize systems and CONOPS that support that identified operational need. At the inception of this ACTD in 1994, no new countermine systems had been fielded since Desert Storm. A survey of developmental programs and technologies showed that near shore and land systems were farther along in development than were naval clandestine reconnaissance systems—hence it was decided that Demonstration I would proceed in FY97 as a dress rehearsal for the full capability demonstration in FY98, when all 12 systems would be available.

Military Utility Assessment

At the outset of the JCM ACTD, there was no accepted approach for assessing the military utility of ACTDs --- though it was recognized that neither classic developmental or operational testing approaches were directly applicable. Making it more challenging was the fact that this was the first system of systems ACTD to field a major demonstration, hence there was no established model to follow.

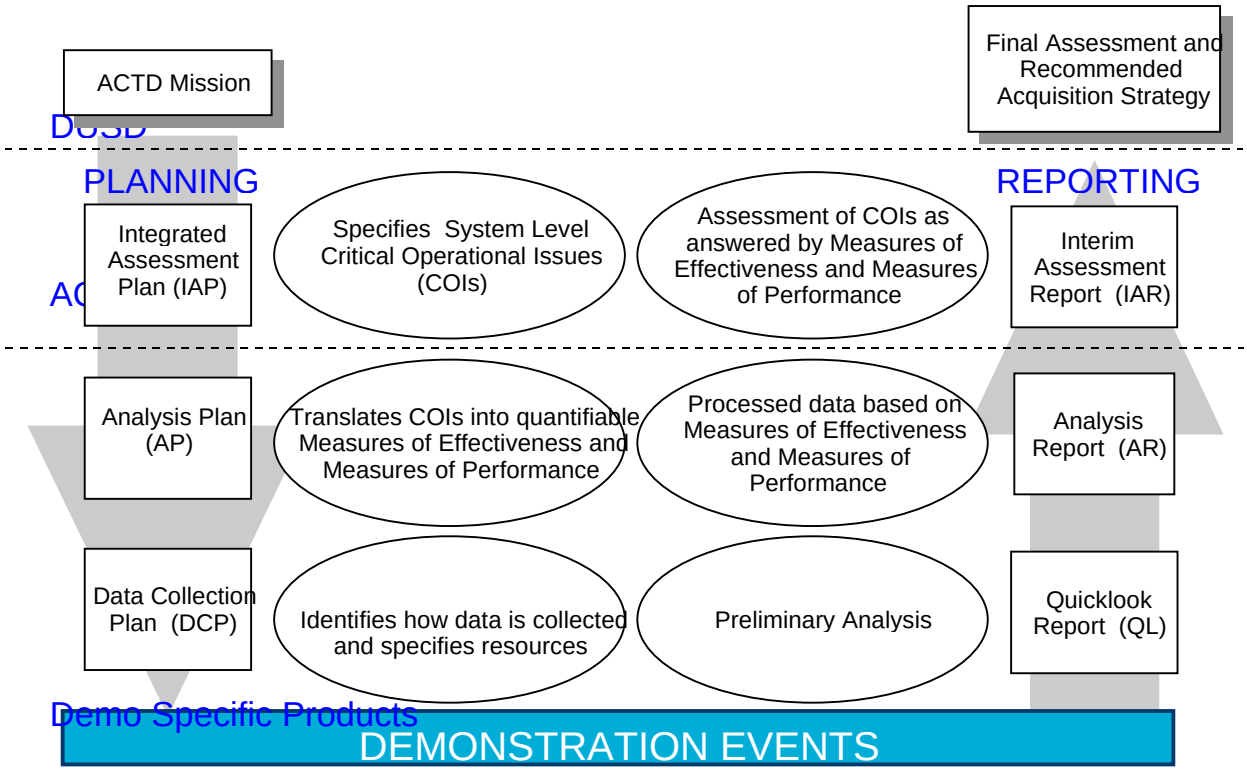
The approach that was developed is one that blends three key elements:

1. data analysis and analyst observations of live systems play in an operational environment
2. structured collection of warfighter impressions regarding systems' military utility
3. modeling & simulation to extrapolate results beyond conditions achievable in live exercises

Measures, analysis methodology, and data collection requirements and sources are documented in the Demo I Analysis and Data Collection Plans[1,2,3]. The evaluation/assessment sequence of events and responsibilities are depicted below. The analysis and data collection plans for Demonstration I were generated in response to the Integrated Assessment Plan (IAP), developed by USACOM's Analysis, Documentation, and Systems Evaluation Cell. The IAP specifies the critical operational issues that concern USACOM with regards to the capabilities the JCM ACTD brings to them for assessment of military utility. The degree to which they have been addressed by Demonstration I is covered in the Conclusions section of this report, indicating where and how Demonstration II activities will provide the additionally required information.

Throughout the Demonstration I and II analysis, both a single system and a system of systems perspective will be maintained with regards to the novel systems. Rather than look at the Demo as having "exit criteria" or pass/fail standards, we look for consistency with expectations when addressing the COIs. This APL/CNA analysis provides the basis for USACOM's understanding of the potential the ACTD elements bring to national countermine capabilities, which they will compare against their understanding of current countermine capabilities to form an assessment of military utility.

[1] JHU/APL Report, "JCM ACTD Demonstration I Analysis Plan", SSD/POR-96-7017R, Feb 97.
[2] JHU/APL Report, "JCM ACTD Demonstration I Data Collection Plan", SSD/POR-96-7015, Mar 97.
[3] CNA Report, "JCM ACTD Demonstration I - Data Collection and Military Utility Assessment Plan", CIM 528, Sep 97.



In summary, the military utility considerations detailed above have driven the scenario, the data collection, and provided a degree of synergism between the analysis, C4I, and JCOS development and utilization. Valuable lessons from the planning and analysis of Demonstration I have been learned and are being applied to the detailed planning phase of Demonstration II.

Demonstration I Overview

This section of the report provides an overview of the JCM ACTD Demonstration I. The JTFEX 97-3 scenario includes the usual geopolitical concerns of notional countries which are overlaid onto the eastern seaboard of the United States. The JCM ACTD activities were confined to Camp Lejeune and Fort Bragg. The geography, scenario, and mine threats are discussed in the main body of the report.

At Camp Lejeune, the amphibious assault took place at Onslow Beach. The beach landing area extended from Onslow South Tower to Riseley Pier, about 1 nautical mile of beach front. The ACTD amphibious breach/assault was conducted against defenses emplaced at two landing areas. The beach south of South Tower was defended by a very shallow water (VSW) minefield and heavy mine/obstacle beach defenses, while the beach just south of Riseley Pier was defended by a separate, lighter mine/obstacle field. The VSW minefield contained a gap for the purpose of detection and exploitation by the assault planners, utilizing the novel systems and legacy systems/forces, as appropriate. Across the intracoastal waterway, in Training Landing Zone (TLZ) Bluebird and Exercise Training Area 2 (ETA-2), there were additional land minefields, including buried and surface-laid anti-tank (AT) and anti-personnel (AP) mines as well as off-route mines (ORMs) protecting anticipated assault force routes.

One of the more difficult planning and execution challenges for Demonstration I was the ground rule that the ACTD would not interfere with operational work-up activities during the JTFEX. This condition was the primary consideration in defining two separate beach minefields separated by about 2000 yards, to provide a landing zone against which the JTFEX's MEU(SOC) certification assault could proceed, unimpeded by the threat of mines and obstacles.

At Fort Bragg, the airfield seizure and lodgment establishment took place at Luzon drop zone at Camp Mackall. There were seven different minefields emplaced in the area on and around the Luzon drop zone. These fields incorporated both metallic and low-metallic, buried and surface-laid, AT and AP minefields.

All of the exercise minefields were designed and emplaced in accordance with current threat doctrine and were validated by the Office of Naval Intelligence (ONI), Marine Corps Intelligence Agency (MCIA), and National Ground Intelligence Center (NGIC).[4]

Demonstration I Novel Systems

There were a total of 9 novel systems participating in this demonstration including 4 reconnaissance systems and 5 breaching/clearing systems. Additionally, the JCM ACTD developed an enhanced C4I architecture with its Joint Countermine Application (JCA) and the Joint Countermine Operational Simulation (JCOS).

The 4 reconnaissance systems that participated in Demonstration I are:

- Littoral Remote Sensing. LRS optimizes the collection geometries of national systems and applies advanced algorithms to detect/locate shallow water and beach obstacles as well as delineate METOC, topographic, and bathymetric parameters. The focus is to optimize sensor detection capabilities and processing algorithms, and to then transition validated, scaleable products to tactical forces.
- Magic Lantern (Adaptation). ML(A) utilizes gated lidar imaging for detection of minefields and obstacles. The ACTD objective is to demonstrate a capability to rapidly detect, classify and localize minefields and obstacles in the surf zone and craft landing zone. Although ML(A) is currently fielded on an SH-2F helicopter, the tactical host would be a UAV.
- Airborne Standoff Minefield Detection System. ASTAMIDS utilizes both passive infrared and active laser technologies to provide the capability to detect and identify the boundaries of patterned and scatterable anti-tank minefields. ASTAMIDS seeks to detect mines/minefields consisting of metallic and nonmetallic surface, buried, and patterned scatterable mines.
- Coastal Battlefield Reconnaissance and Analysis. COBRA is a planned UAV-based multi-spectral optical sensor system for detecting minefields/obstacles in the beach/CLZ region with potential inland applicability.

[4] JHU/APL Report, "Minefield Annex to JCM ACTD Demo I Playbook (Version 2.0)", SSD/POR-97-7091, Jul 97.

There were five breaching/clearing novel systems participating in Demonstration I :

- Explosive Neutralization Advanced Technology Demonstration. EN(ATD) consists of 3 explosive systems and a Fire Control System (FCS). The explosive systems are (1) a Line Charge, (2) a Surf Zone Array, and (3) a Beach Zone Array (BZA). Only the FCS was demonstrated in Demonstration I.
- Joint Amphibious Mine Countermeasures. JAMC provides the capability to clear mines and light obstacles from the high water mark to the craft landing zone in support of an amphibious assault, but not as the lead assault element. The system employs remote-controlled bulldozers with mechanical, explosive and electro-magnetic sub-systems in addition to visual and electronic marking devices.
- Clausen Power Blade. The PB provides the capability to clear, reliably and quickly, AT mines and heavy obstacles from assault lanes and wider areas. The system is integrated into an armored D-8 dozer with a standard angled cutting edge.
- Close-In Man Portable Mine Detector. CIMMD utilizes a standoff infrared thermal imager, a confirming ground penetrating radar, and a metal detection sensor to detect surface and buried metallic and nonmetallic land mines.
- Off Route Smart Mine Clearance. ORSMC consists of a tele-operated HMMWV platform that replicates critical signatures of target vehicles in order to cause a launch of the smart mine munition. Major components of the system include a tele-operated HMMWV, acoustic subsystem, seismic subsystem, signature management suite, and an IR decoy.

The ACTD augmented the legacy C4I architecture in order to integrate currently fielded and prototype systems as well as take advantage of selected developing capabilities in C4I. Beyond developing a tailored C4I architecture that would support providing a common tactical countermine picture throughout all levels of command, the JCA software was developed which operates in a Joint Maritime Command Information System (JMCIS)/Global Command and Control System (GCCS) compliant environment as well as providing a Tactical Packet Internet Protocol (TCP/IP) capability. The JCA consists of three basic elements: a core JCM segment, tailored Mission Planning and Evaluation segments, and an ISR segment. JCA also supported quantitative data collection through the C4I network to support this analysis.

JCOS is a modeling & simulation software package designed to simulate full functionality of each novel system and appropriate fielded military equipment in a distributed, interactive, training, and tactical decision-making simulation. It is intended to support: (1) development of operational concepts, doctrine, tactics, techniques, and procedures, (2) evaluation of concepts and novel systems for military worth, (3) promotion of joint tactical training, and (4) conduct of operational exercises through injection of simulated entities via C4I connectivity.

There were other countermine systems participating in the JTFEX and the JCM ACTD; the following two systems were most directly relevant to the ACTD assessment. The VSW MCM Detachment, consisting of marine mammals, NSW, EOD, and USMC Force Reconnaissance teams, was used to find the gaps or lightly mined areas in the VSW/SZ minefield emplaced specifically for the ACTD landing. Because their operations were closely coordinated with the novel systems operation, their performance is discussed in this report. Additionally, the AN/PSS-12 hand-held detector was used in conjunction with CIMMD for route clearance and the results of its use are also presented in this report.

Demonstration I Events Summary

JTFEX 97-3 began on 18 August and was completed on 5 September. With the exception of the reconnaissance missions, the ACTD took place during the last few days of the JTFEX. The beach and sea minefields were initially emplaced at Camp Lejeune between 4 and 8 August. ML(A) and COBRA pre-collect flights were conducted on 9 through 13 August as a hedge against bad weather later in the month. LRS baseline collections began 30 June and continued through 4 September. Fort Bragg minefield emplacement occurred on 18 and 25 August and 1 September. The ASTAMIDS tactical flights took place at Ft Bragg on 25, 26, and 27 August. The ML(A) and COBRA tactical flights were flown on 28 and 29 August, around the same time the VSW MCM Det conducted operations (27, 29, and 31 August). The COMPHIBGRU Two and 2nd Marines staffs stood up at LWTC on 2 September to begin planning for the amphibious assault. The airfield seizure took place at Ft Bragg in the early morning hours of 2 September and the amphibious assault night rehearsal was conducted on 4 September with D-day occurring on the morning of 5 September.

Demonstration I Results Summary

This main body of the report presents the results from the Demonstration by sub-phase, beginning with the Reconnaissance and Mission Planning sub-phase followed by those sub-phases leading up to and through the air and amphibious assaults and follow-on clearance operations. A discussion of C4I and modeling and simulation activities concludes this major portion of the report. The conclusions section, summarized here, provides perspectives to the ACTD activities by: addressing the degree to which Demonstration I has provided insight into the COI assessment, identifying the complementary nature of Demonstrations I and II, and providing recommendations regarding Demonstration II.

The JCM ACTD Management Plan provides for one major demonstration each in FY 97 and FY 98, followed by a two-year residuals phase. The Demonstrations are viewed as complementary, with Demo I providing a dress rehearsal for the primary Demonstration II. Generally speaking, Demo I is meant to introduce the users to the novel systems, enhanced C4I, and JCOS. During Demo II, the appropriate service component staffs will plan and direct the use of these ACTD elements to their fullest capabilities in a freeplay environment.

Demo I was scripted, emphasizing live system play, with very little injection of forces and systems by JCOS. Because the operational planning staffs were not available far enough in advance of the JTFEX 97-3, the developers' informed view of CONOPs were used in the demonstration–a good starting point, but the warfighters' generally innovative approach to utilizing new system capabilities was not leveraged. Although useful in gathering hard system performance data under operational conditions, the primary focus of Demo I was to solicit warfighter feedback on suitability, potential military utility, and to identify performance issues for resolution prior to bringing the systems back for Demo II.

Analysis results and lessons learned are now organized and applied in turn to each COI identified by USACOM's IAP. The degree to which they have been satisfied by Demonstration I is addressed, indicating where and how Demonstration II activities will provide the additionally required information. In most cases, Demonstration II offers a necessary additional opportunity for the warfighter to plan and exercise with the novel systems, C4I, and JCOS.

COI #1: Do the ACTD Components Individually and Collectively Enhance the Capability of the Joint Task Force (JTF) Engaged in a Joint Amphibious Assault and Follow-On Land Operations to Surveil, Recon, Detect, Neutralize, Breach, Mark, and Clear Mines, Minefields, and Obstacles?

The first COI generally asks whether the ACTD novel systems significantly contribute to finding and clearing mines. During the demonstration, the following observations are relevant:

- Regarding beach mine/obstacle field reconnaissance, the LRS characterization was sufficient and timely, and the COBRA and ML(A) products did not enhance that characterization, and in some cases would have been counterproductive. However, exercise artificialities allowed LRS to focus precisely on the Onslow Beach minefields; in a tactical situation, broad area LRS reconnaissance would need to cue focused reconnaissance to a precise beach location. Additionally, the on-scene commander would compete for national collection assets and thus would more highly value having command of such flexible local area reconnaissance systems such as COBRA and ML(A).
- ML(A) detected one VSW mineline, but did not resolve the gap intentionally provided for the assault planners to discover. The VSW optical environment was particularly challenging.
- ASTAMIDS was unable to detect buried mines at Fort Bragg. The primary system was unavailable, hence a backup ASTAMIDS was utilized for the demonstration.
- COBRA sensors detected AT mines in ETA-2, but it did not declare a minefield, because the minefield density was insufficient to satisfy the minefield detection criteria.
- The Power Blade cleared its tasked area of heavy obstacles and mines in less time than anticipated. Blade survivability against live ordnance still needs to be tested.
- JAMC could not complete its clearance tasking against light obstacles and mines, and therefore did not demonstrate utility to its follow-on clearance mission. The tele-remote, marking, and mine rake subsystems were favorably viewed by the CEB.
- Due to a problem with its host MCAC, the EN(ATD) fire control and autonomous controller did not operate during the primary landing on 5 September. Data gathered during the 4 September rehearsal indicated good performance, and analysis is in progress on its full system demonstration that occurred at Tyndall AFB on 25 September.
- ORSMC's opportunity to demonstrate utility in the ARFOR subphase was constrained by "freeplay"/tampering with ORM simulators, and poor reliability of ORM simulators. Further analysis regarding the impact of the incomplete threat representation by the ORM simulators is advised.
- CIMMD was unable to detect buried mines at Fort Bragg. Although CIMMD detection performance was much improved at Camp Lejeune (approximately equivalent to the AN/PSS-12) the high false alarm rate greatly inhibited forward movement.

In conclusion, it can be said that all the novel systems except JAMC showed promise of enhancing legacy system of systems' capabilities, but further evaluation through participation in Demonstration II is recommended.

COI #2: Do the ACTD Components Individually and Collectively Enhance the JTF Commander's Exercise of Command, Control, and Planning to Employ Countermine Technology in his Area of Operations?

COI #2 concerns enhanced C4ISR capabilities brought by the ACTD. Specific observations regarding Demonstration I include:

- There were no OPFOR C4I countermeasures.
- The reliability of the new interfaces established from the novel systems to their local C4I nodes via SIPRNET was satisfactory.
- Tactical support established for the C4I network had some reliability problems involving the SIPRNET node at LWTC and RF net connectivity. The SIPRNET problems were administrative in nature while the RF NET problem was due to JAMC data saturation.
- Due to the aforementioned lack of sufficient staff planning time, the tasking, delivery and utilization of some reconnaissance products was inhibited. Dissemination of LRS products was delayed due to not having a "kickoff message" and late staff stand-up.
- The JCA reliability was good with the exception of the USS Inchon installation, which required software reloads after attempting to load map data. They were unable to archive and save databases without locking up the system.
- The JCA was used extensively at the LWTC by the CPG-2 staff to plan the amphibious assault and breaching operations.

In summary, automated/interoperable information access, management and transfer was successfully demonstrated, and the development, maintenance and dissemination of a coherent tactical picture was partially demonstrated. Moreover, the JCA enabled sharing of legacy and novel systems' countermine reconnaissance products among various commands. For example, ML(A), COBRA and ASTAMIDS each generated volumes of useful data that were integrated into a useful display of situational awareness with flexible filters and controls to help manage the data. Demonstration II is necessary to fully assess this COI.

COI#3: Do the ACTD Components Demonstrate the Potential to Meet the Deployability, Transportability, and Logistics Requirements of the JTF?

COI # 3 refers to suitability of the novel systems' use in the tactical environment by soldiers, sailors, and marines. Although not fully assessed during Demonstration I, the following specific observations can be made:

- All the novel systems can be transported to the battlefield, although those reconnaissance systems planned to be UAV-based have yet to address packaging and platform interoperability issues. Also, Power Blade is at the upper limit of the LCAC load capacity, which restricts operations to very low sea states.
- Demonstration I was the first time that the TACMEMO "Amphibious Operations in a Mined Environment" was executed in a live exercise. The planning and execution of the amphibious assault at Camp Lejeune exposed some doctrinal difficulties that need to be resolved in order to successfully (no/low loss criteria) execute this type of operation in the presence of a beach defended by a combination mine/obstacle threat.
- Due to weight/form factor considerations the Power Blade came ashore on an LCAC. However, its follow-on clearance role is specifically to clear an area for the LCAC to

land/discharge cargo. Successful deployment of the EN(ATD) SZ and BZ arrays may ensure successful discharge of the Power Blade seaward of the obstacle field.

- Although analysis is incomplete, indications are that AAV lanekeeping in mined waters is problematic, as well as accurate placement/utilization of the Breach Lane Navigation System.
- A variety of readiness and availability issues were also experienced for the LCAC, AAVs, CIMMD, ORSMC, and LRS (difficulty was experienced in sequencing some collections).
- CIMMD and ORSMC demonstrated the capability to be utilized by both soldiers and Marines.

Demonstration II should attempt to use military operators for all systems to more effectively address this COI.

COI #4: Can JCOS Effectively Model the ACTD Components and Support Operations, Exercises, Planning, Rehearsal, and Analysis?

COI #4 refers to the ability of JCOS to support operations, planning, rehearsal and analysis. This was only partially addressed during Demonstration I. During Demo I, JCOS successfully demonstrated the ability to inject simulated entities over the tactical C4I network via the JCA, as indicated above. JCOS is expected to have a much expanded role in Demonstration II, especially in support of staff planning and rehearsals. Subject to C4I bandwidth considerations, JCOS should be used to populate the battlespace with additional legacy and novel systems to a tactically representative level during Demo II.

<u>Demonstration II Recommendations</u>

Demonstration II should include an expanded staff planning phase, which more thoroughly examines and integrates ISR, C4I, and JCOS and assesses their impact on staff decisions. This was inhibited during Demo I due to the late stand-up of component staffs and the compressed, scripted nature of the ACTD play in JTFEX 97-3. During the execution phase, each novel system should be re-played in essentially the same role that they had for Demo I (although in a freeplay task/response mode) with much greater use of simulation, especially for legacy systems. Because Demo II will be in the spring of 1998, this should offer an opportunity to leverage the staffs and possibly operational forces' experience with the ACTD prior to the usual summer turnover. Finally, environmental and threat applicability of some novel systems should be fully considered by planning staffs because novel system performance is dependent on these factors.

The intent for Demo II is to utilize the staff planning process to integrate the novel systems into the existing systems of systems, with the aid of JCOS and the enhanced C4ISR capabilities brought by the ACTD. If tasked and stood up sufficiently early, this will enable the users to develop optimized CONOPS and provide a venue for a second look at those systems that played in Demo I, as well as a first look at the four systems that will be participating for the first time: Advanced Lightweight Influence Sweep System (ALISS), Near Term Mine Reconnaissance System (NMRS), Advanced Sensors, and the Army Classified Program (ACP).